

Dates for tsunamis

Light on an ancient problem

The Boxing Day disaster can help date ancient tsunamis, giving us a guide for the future. Paul Bishop, David Sanderson and Jim Hansom explain.



The tsunami of 26 December 2004 killed thousands and devastated Indian Ocean coastlines. In Thailand, the British Geological Survey was one of the first international agencies to help in mapping and understanding the tsunami and its effects. A few months later, we three Glasgow geoscientists received a fast-track NERC 'urgency' grant to examine the tsunami deposits in Thailand in more detail.

The idea was to use modern tsunami deposits to test a method of dating deposits from ancient tsunamis. Knowing when ancient tsunamis happened helps establish how often they've occurred in the past, so providing a guide for the future. We already use a technique called optically stimulated luminescence (OSL) dating on tsunami deposits, such as those in northern Britain from the tsunami triggered by the Storegga submarine landslide, 7,000 years ago.

OSL exploits the damage done to the mineral structure of quartz and other minerals in sediments by low-level natural radioactivity around them. If the amount of structural damage and the natural radioactivity can both be measured, then the time since the sediment was laid down can be calculated. The amount of

damage is measured in the laboratory by heating or by exposing the sediments to lasers to 'repair' the damage. During repair, the sediment grains emit light flashes or luminescence. Measuring these indicates the amount of damage.

For this dating clock to work it must have been set to zero when the sediments were deposited. Exposing the sediment to sunlight does this, just as laboratory heating or the laser does. But if sunlight didn't repair all the damage at the time of the tsunami, some residual luminescence will remain, suggesting ages for the deposit that are too old.

The OSL ages of the tsunami deposits in Thailand should be zero because they are so recent. Expertly guided by Niran Chaimanee, the Thai Government's Department of Mineral Resources' senior coastal scientist, we collected about 200 samples from a range of settings: open coastline; landward transects from the tsunami-damaged beach; sheltered bays; and shaded and unshaded settings. We also sampled muddy deposits to check whether they had received less sunlight while being carried inland by the muddy tsunami wave. We were using new equipment built by David Sanderson for taking measurements on site, a

technology with enormous potential for assessing sediments of any provenance (not just tsunami deposits).

Initial analyses show that all the Boxing Day tsunami sediments have residual luminescence 'ages', mostly of only about ten years, but some up to a thousand years old. These increase inland, and one possibility is that the tsunami picked up more 'old' unzeroed sediment as it moved inland. Or was 'old' buried and unzeroed sediment from deeper water (or even the beach) carried further inland? The sediments' shell and coral content may tell us more. In any event, it is clear that future OSL dates for ancient tsunami deposits will need to take better account of the sediment's source, and how it is transported and deposited. Next, we hope to establish which sediment gives a zero age, so that we can use them in dating ancient tsunami deposits.

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